

13 Summary

13.1 Conclusions

The following conclusions are based on the findings of this study and should be considered “point in time” (i.e. based on the industry’s current understanding, or lack of understanding, of the phenomena known collectively as SCC). Additional research and data compilation is expected in this area, and the study conclusions should be revised accordingly (see Section 9, and particularly Section 9.3.4 and Figure 9-1 for research priorities).

In general, the emphasis for dealing with SCC is on awareness, qualification of personnel, planning, and documentation. It is recognized that there are currently no plans or actions that can adequately address all situations, especially given the current state of data and knowledge concerning SCC.

13.1.1 Design

- Linepipe - Although much research has been done on linepipe steel, no specific conclusions are made as regards to grade or metallurgy. However, manufacturing processes that minimize residual tensile stresses in the pipe should be considered.
- Coating – FBE, which is the modern coating of choice, appears to offer good resistance to SCC when coupled with an effective and complete specification for application. There are other coatings that potentially offer good resistance to disbondment that could also be considered, but have less experience industry wide. For new pipelines, tape coatings should not be used where there is a risk for SCC—and, at the least, tape coatings should be critically assessed to ensure against disbondment. For recoatings FBE is usually not practical, so the type of coating should be carefully considered to ensure that the recoated section achieves full protection, and perhaps some additional research is indicated in this area.
- Alignment – the operator should consider completing an initial SCC threat assessment, using an internal evaluation technique (such as that described below) to prioritize segments, which have a high susceptibility to SCC. Where possible, consideration should be given to additional QA/QC oversight of coating installation for these segments, additional protection against holidays, and realignment where possible in high threat circumstances.

13.1.2 Construction

- Coating installation and repair specifications, citing surface preparation and application procedures to ensure bonding and quality coatings, should be considered for inclusion in the contract documents.
- QA/QC procedures for coating installation should be implemented by qualified personnel, trained in NACE or similar procedures.

13.1.3 Operations

- Procedures to ensure the operating temperature remains within design limits of the coating and bonding mechanism should be developed.
- Operational awareness of the detrimental effects of temperature excursions should be available in the operational procedures, with accompanying procedures for engineering evaluation in the event of temperature excursions.
- When SCC is found, an immediate response for gas pipelines is required, which necessitates a reduction in pressure. In lieu of other information, the pressure reduction will be to a value not exceeding 80% of the pressure at the time the anomaly is discovered. In any case, and for both gas and liquid pipelines, the anomaly should be critically evaluated for determination of the safe operating limits based on the best available data. The daily pressure history should be available in a form conducive to engineering evaluation.

13.1.4 SCC Awareness Program

- An operator education program, explaining the causes and identification of SCC to field personnel, should be developed and readily available.
- A core cadre of operator personnel should be NACE, or similar professional organization, qualified, and designated in operating plans as corporate resources for addressing SCC.
- To the extent possible and appropriate, operator engineering personnel should have continuing education in the areas of SCC and be encouraged to keep abreast of research in SCC.

13.1.5 SCC Detection through ILI

- A written document that identifies the practicality of ILI tools in detecting SCC for the operator lines should be completed for each major operating pipeline. Although, and as discussed in this report, SCC detection in gas pipelines using ILI may not be currently considered practical, at least by some operators and for some lines, the tool development is rapidly advancing and close attention should be focused on ILI capability in this regard.
- An internal database that tracks the effectiveness of an ILI tool in detecting SCC on the operator's lines should be developed and regularly updated. Error bands for detection should start with vendor data and be refined through the use of this database. The error bands should be included in SCC threat assessment techniques. As discussed in this report, this may currently be problematic for most gas pipelines since the tool capability is probably not compatible with a detailed effectiveness tracking procedure at this time, but the tool development is rapidly advancing and close attention should be focused on ILI capability in this regard.

13.1.6 SCC Detection through Direct Examination

- Anytime the pipe is uncovered, the pipe assessment should include consideration of the possibility of SCC.
- Direct Examination methods should be reviewed to ensure that SCC awareness is included in all direct examination techniques. “Triggers” for more detailed SCC techniques, such as coating disbondment, should be identified.
- Written procedures for examination of pipe segments with potential SCC should be developed.
- Personnel with experience and/or detailed education of SCC should be included in all investigations when there is a possibility of SCC.
- Data collection forms should be developed, completed and stored for each SCC Direct Examination threat assessment.
- An engineering evaluation procedure should be developed and followed for determination of the SCC threat. It is recognized that there is no single formula or software code that will address this complicated technical evaluation. Further, different operators may find different approaches are more appropriate to their circumstances. The engineering procedure should acknowledge this and allow for different metallurgical, environmental, and mechanical factors as well as consideration for a change in approach as understanding progresses. This could be done as part of a more general corrosion engineering procedure. Nevertheless, the engineering approach should be documented and readily available throughout the organization to ensure a base level of consistency in all pipelines within the operator’s purview.

13.1.7 SCC Remediation

- Specific repair techniques should be developed and updated as required for SCC. The repair techniques should clearly identify the threat assessment limits for which the repair is applicable.
- Operating procedures that mitigate the SCC threat until repairs are completed should be developed, again with clearly identified threat assessment limits for which the procedure is applicable.
- Engineering evaluation procedures that are adjusted based on the repair evaluation should be developed and followed.

13.1.8 IM Program – SCC

- The Protocols should be examined to ensure that the IM plan meets all minimum requirements.
- Historical evidence of SCC should trigger specific additional requirements for the applicable lines.

13.1.9 Response to In-Service Failure

- Any in-service failure investigation should consider the possibility of SCC causing or exacerbating the failure occurrence.
- Qualified staff knowledgeable in the causes and identification of SCC should be detailed to respond to an incident that may include SCC.
- Data collection forms should be developed, completed and stored for each SCC failure investigation.
- SCC examinations should include plans for metallurgy examination, immediate reduction of pressure and/or other mitigative means, and a plan to return to service that includes not only an evaluation of the site but also consideration of additional areas which have similar threat indicators.

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